

WHAT IS CLAIMED IS:

- 1 1. A method for treating a substrate surface, comprising the steps of:
2 coiling one or more substrates into one or more coils in such a way that adjacent
3 turns of the coils do not touch one another;
4 placing the one or more coiled substrates in a treatment chamber; and
5 in the treatment chamber, treating substantially an entire surface of the one or
6 more coiled substrates with a surface treatment process.
- 1 2. The method of claim 1 wherein the surface treatment process includes one or
2 more atomic layer deposition (ALD) reactions.
- 1 3. The method of claim 2 wherein the one or more ALD reactions include exposing
2 the surface of the coiled substrate to a reactant vapor of the type MCl_x , where M is
3 a metal and x is an integer from one to four.
- 1 4. The method of claim 3, wherein the one or more ALD reactions include exposing
2 the surface of the coiled substrate to water vapor.
- 1 5. The method of claim 3 wherein MCl_x is $TiCl_4$.
- 1 6. The method of claim 1 wherein the surface treatment process includes
2 anodization.
- 1 7. The method of claim 1 wherein the surface treatment process includes drying.
- 1 8. The method of claim 1 wherein the surface treatment process includes annealing.
- 1 9. The method of claim 1 wherein the surface treatment process includes exposure to
2 reactive gas or vapor.
- 1 10. The method of claim 9 wherein the exposure to reactive gas or vapor includes
2 selenization.
- 1 11. The method of claim 1 where the surface treatment includes anodization.
- 1 12. The method of claim 1 where the surface treatment includes electrodeposition.
- 1 13. The method of claim 1 where the surface treatment includes electropolishing.

- 1 14. The method of claim 1 wherein coiling the substrate includes attaching an end of a
2 roll of substrate material to a carousel, rotating the carousel while unrolling the
3 substrate material from the roll to coil the substrate around the carousel, and
4 placing one or more spacers between adjacent layers of the coiled substrate before
5 the carousel completes a turn.
- 1 15. The method of claim 14 wherein each spacer touches a back surface of the
2 substrate but not a front surface of the substrate.
- 1 16. The method of claim 14 wherein placing one or more spacers includes stacking
2 one or more spacers on top of one another.
- 1 17. The method of claim 1 wherein coiling the substrate includes attaching an end of a
2 roll of substrate material to a carousel, moving the roll of substrate material
3 around the carousel while unrolling the substrate material from the roll to coil the
4 substrate around the carousel, and placing spacers between adjacent layers of the
5 coiled substrate before the roll completes a turn about the carousel.
- 1 18. The method of claim 1 wherein the one or more substrates include two or more
2 substrates coiled side-by-side on a carousel.
- 1 19. The method of claim 1 wherein coiling one or more substrates into one or more
2 coils in such a way that adjacent turns of the coils do not touch one another
3 includes placing a spacer tape between adjacent turns of the substrate.
- 1 20. The method of claim 19 wherein the spacer tape is orientated substantially parallel
2 to a length of the substrate.
- 1 21. The method of claim 19 wherein the spacer tape includes one or more passages
2 running substantially along a width of the spacer tape.
- 1 22. The method of claim 1 wherein coiling one or more substrates includes attaching
2 two substrates together back-to-back to form a dual substrate and coiling the dual
3 substrate.
- 1 23. The method of claim 22, further comprising separating the two substrates after
2 they have been treated in the treatment chamber.

- 1 24. A substrate surface treatment system, comprising:
2 a surface treatment chamber;
3 a carousel adapted to receive a flexible substrate material as a coil, the carousel
4 being sized to be received within the chamber with the substrate material coiled
5 around the carousel in one or more turns;
6 a winding mechanism configured to coil the substrate material about the carousel
7 to form a coiled substrate; and
8 one or more spacers, the spacers being configured to space apart adjacent turns of
9 the coiled substrate in such a way that the adjacent turns of the coiled substrate do
10 not touch one another; and
11 a mechanism adapted to place one or more of the spacers between adjacent layers
12 of the coiled substrate before the winding mechanism winds a full turn of the
13 substrate material about the carousel.
- 1 25. The system of claim 22, further comprising one or more sources of reactant gas
2 coupled to the chamber, the reactant gas being of a type suitable for performing
3 atomic layer deposition.
- 1 26. The system of claim 22, wherein the chamber is an anodization chamber.
- 1 27. The system of claim 22, wherein the carousel is in the shape of a polygonal
2 cylinder.
- 1 28. The system of claim 25 wherein the carousel is in the shape of a hexagonal
2 cylinder.
- 1 29. The system of claim 22 wherein the spacers can be secured in place with respect
2 to the carousel.
- 1 30. The system of claim 22 wherein the spacers can stack on top of one another.
- 1 31. The system of claim 22, wherein the spacers include one or more spacer tapes.
- 1 32. The system of claim 29 wherein the spacer tapes run substantially parallel to a
2 length of the substrate.

- 1 33. The system of claim 29 wherein at least one spacer tapes is located proximate a
2 side of the substrate.